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Claims

[c1] Unknown;SLB;1.A system for determining a property of a subsurface formation traversed by a borehole, comprising:
a sub having an elongated body with tubular walls and an inner bore, the sub adapted for disposal within the borehole;
a run-in tool adapted for disposal within the sub bore; and
the run-in tool having at least one radiation source or at least one radiation sensor disposed thereon;
wherein the sub wall includes an inner passage adapted to direct radiation energy emitted from within the sub back toward the sub bore.

[c2] 2.The system of claim 1, wherein the at least one radiation source is one of a neutron source or gamma-ray source.

[c3] 3.The system of claim 1, wherein at least one radiation sensor on the run-in tool is located near the inner passage in the sub wall when said tool is disposed within the sub bore.

[c4] 4.The system of claim 2, wherein the formation property is density or porosity.

[c5] 5.The system of claim 1, wherein the run-in tool is adapted for retrieval from the sub bore when the sub is disposed within the borehole.

[c6] 6.The system of claim 1, wherein the sub comprises receiving means adapted to eccenter the run-in tool within said bore when said tool is disposed therein.

[c7] 7.The system of claim 1, the sub further comprising at least one blade extending outward from its outer circumference.

[c8] 8.The system of claim 7, wherein the inner passage adapted to direct radiation energy emitted from within the sub back toward the sub bore is located in the at least one blade.

[c9] 9.The system of claim 1, the sub further including at least one partially penetrating window formed in its wall.

[c10] 10.The system of claim 9, the sub further comprising at least one blade extending outward from its outer circumference, wherein the at least one partially penetrating window is located on said at least one blade.

[c11] 11.The system of claim 9, wherein a radiation source or

a radiation sensor on the run-in tool is located near the at least one partially penetrating window on the sub when said tool is disposed within the sub.

[c12] 12.The system of claim 1, the run-in tool further comprising at least one antenna adapted to transmit or receive electromagnetic energy.

[c13] 13.The system of claim 1, the sub further comprising at least one fully penetrating opening along the tubular wall and means to provide a pressure barrier between the interior and exterior of the tubular wall at the at least one fully penetrating opening.

[c14] 14.The system of claim 13, wherein a radiation source or a radiation sensor on the run-in tool is located near the at least one fully penetrating opening along the sub wall when said tool is disposed within the sub.

[c15] 15.The system of claim 1, wherein the run-in tool comprises a neutron source, a gamma-ray source, and a plurality of radiation sensors.

[c16] 16.A system for determining a property of a subsurface formation traversed by a borehole, comprising:
a sub having an elongated body with tubular walls and an inner bore, the sub adapted for disposal within the borehole;

the sub including at least one fully penetrating opening and at least one partially penetrating window along the tubular wall;

the sub including a pressure barrier between the interior and exterior of the tubular wall at the at least one fully penetrating opening;

a run-in tool adapted for disposal within the sub bore;

the run-in tool including at least one radiation source or at least one radiation sensor;

wherein at least one radiation source or at least one radiation sensor on the run-in tool is located near a partially penetrating window on the sub when said tool is disposed within the sub; and

the sub wall including an inner passage adapted to direct radiation energy emitted from within the sub back toward the sub bore.

[c17] 17.A method for determining a property of a subsurface formation traversed by a borehole, comprising:

a)adapting a sub for disposal within the borehole, the sub having an elongated body with tubular walls and an inner bore, the sub wall including an inner passage adapted to direct radiation energy emitted from within the sub back toward the sub bore;

b)disposing a run-in tool within the sub bore, said tool having at least one radiation source and at least one ra-

diation sensor disposed thereon;

c)emitting radiation energy into the formation from the at least one radiation source on the run-in tool; and

d)detecting radiation energy with the at least one radiation sensor on the run-in tool to determine the formation property.

[c18] 18.The method of claim 17, wherein step (b) includes disposing the run-in tool within the sub bore prior to disposing the sub within the formation.

[c19] 19.The method of claim 17, wherein step (b) includes conveying the run-in tool through the borehole for disposal within the sub bore when the sub is disposed within the formation.

[c20] 20.The method of claim 17, wherein step (b) includes eccentering the run-in tool within the sub bore.

[c21] 21.The method of claim 17, wherein step (d) includes detecting the radiation energy with the at least one radiation sensor as the sub is moved along the borehole.

[c22] 22.The method of claim 21, wherein step (d) includes rotating the sub within the borehole.

[c23] 23.The method of claim 22, further comprising associating the detected radiation energy with an azimuthal seg-

ment of the borehole.

[c24] 24.The method of claim 17, wherein step (b) includes determining the alignment of the run-in tool within the sub bore by detecting radiation energy passing through said inner passage in the sub wall.

[c25] 25.The method of claim 17, wherein the at least one radiation source is a neutron source or a gamma-ray source.

[c26] 26.The method of claim 25, wherein the formation property is density or porosity.

[c27] 27.The method of claim 17, wherein the sub includes at least one partially penetrating window formed in its wall.

[c28] 28.The method of claim 27, wherein step (b) includes positioning the run-in tool within the sub bore such that the at least one radiation source or the at least one radiation sensor is located near the at least one partially penetrating window.

[c29] 29.The method of claim 28, wherein step (b) includes determining the alignment of the run-in tool within the sub bore by detecting radiation energy passing through said inner passage in the sub wall.

[c30] 30.The method of claim 17, wherein the sub includes at

least one fully penetrating opening formed along its wall.

[c31] 31.The method of claim 30, wherein step (b) includes positioning the run-in tool within the sub bore such that the at least one radiation source or the at least one radiation sensor is located near the at least one fully penetrating opening in the sub wall.

[c32] 32.The method of claim 31, wherein step (b) includes determining the alignment of the run-in tool within the sub bore by detecting radiation energy passing through said inner passage in the sub wall.